THE NORMAL
School Quarterly

Volume 3 October, 1904 Number 1

Nature Study
In its Practical Bearings.

By

JOHN P. STEWART

Entered August 16, 1902, Normal, Illinois, as second class matter
under Act of Congress of July 16, 1894

PUBLISHED BY THE ILLINOIS STATE
NORMAL UNIVERSITY, NORMAL, ILLINOIS

N. B.—If you do not want the Quarterly please write
immediately stating at what change of address

C
IL6N5
Stack

THE LIBRARY OF THE
DEC 9 - 1938
UNIVERSITY OF ILLINOIS

NORMAL SCHOOL QUARTERLY

Published by the Illinois State Normal University, Normal, Illinois

Series 3 *October, 1904* *Number 13*

Nature Study in its Practical Bearings.

In the preface to his excellent book, *Principles of Agriculture,* Bailey says, "A book like this should be used only by persons who know how to observe. The starting point in the teaching of agriculture is nature study." Again he says, "The purpose of [agricultural] education is often misunderstood by both teachers and farmers. Its purpose is to improve the farmer, not the farm. If the person is aroused, the farm is likely to be awakened ..... If the educated farmer raises no more wheat or cotton than his uneducated neighbor, his education is nevertheless worth the cost, for his mind is open to a thousand influences of which the other knows nothing. One's happiness depends less on bushels of corn than on entertaining thoughts." It is evident that no amount of agricultural precept will reveal to an unobservant man what is going on about him. Our first duty, therefore, plainly lies in teaching how to see, how to reason from what is seen, and to love and appreciate natural things. This is nature study, and the training it gives is good for living as well as for farming. It is to set forth this relation of nature study to agriculture and life, and to call attention to the desirability and practicability of extending its influence thruout our Illinois schools, that this paper is written.

The Bureau of Statistics shows that the value of the principal agricultural crops in the United States during 1903 was $3,200-000,000, while that of all manufactured articles was less than one billion dollars. This indicates that over 75 per cent of our creative livelihood still comes from the farm, from intimate contact with plants and with the soil. Nowadays we hear much of an education for the life that one is to live. Yet the cultivation of intelligence directly necessary to maintain this tremendous industrial activity is dependent upon a few agricultural colleges, experiment station bulletins, and institute instructors, plus the precarious transmission of methods from father to son. That this is far from adequate is shown on every hand. The farmer boy doesn't like to spend the money necessary to take him to college. The bulletins are ineffective because he doesn't understand experimental methods and because he is often unfamiliar with the objects considered, altho they may be surrounding him daily. The consequence is that thousands of men go on, daily and yearly repeating mistakes that might easily be corrected if they only knew of the available literature and could really read it.

The failures and losses due to this destructive ignorance are enormous. In our own state, according to Professor Forbes, "The insects alone probably derive as large a profit from the agriculture as do the farmers themselves. They cost us at least half as much as the whole system of public schools, and a very large percentage of this great loss might certainly be prevented, if we could bring the economic facts of this one department into the store of common knowledge at the command of every pupil in town and country school. That we fall far short of this requirement is evident. The Hessian fly is not known at sight in the adult stage or in the main features of its biography to one in hundreds of those who suffer pitifully from its ravages." He might have said the same thing about the codlin-moth, the army worm, the May beetle, and sev-

eral other ravenous insects. It is conservatively estimated that a tenth of all our crops is lost to insects—a yearly loss that would make millionaires of more than three hundred of us per year—not to mention their influence in the conveyance of disease and of unhappiness generally.

On the other hand if we look into the lives of another group of our animal contemporaries and recall the record of Professor Treadwell's young robins, which daily required their own weight of insects to prevent actual starvation; and if we recall the calculations of the Department of Agriculture to the effect that every toad in our garden is worth $19.80 per season, because of the insects, cabbage "worms" and slugs that it eats, we may begin to see the value of discriminating between our friends and foes, of seeking out and encouraging the one, among birds and insects and every living thing, and of discouraging the other. Who will care if the robin does take a few cherries later in the season, when he knows what a powerful ally it has been in protecting the crops against possibly pints of voracious insect larvae? And yet we still see the small boy out on all possible occasions stoning the toads or practising with his new gun, and improving his marksmanship at the expense of the downy or the hairy woodpecker that never ate any of his fruit but was giving its strength to ridding his apple trees of the codlin-moth and destructive borers. And his excuse, when he has one, is that it was only an old sap-sucker.

But the industrial waste and mistaken effort, which thus directly affect more than half of our earning capacity as a nation, are not our only failings. Few people get the *pleasure* out of life that the all-wise Creator designed that they should. We go thru too much of life with our ears and eyes closed. Why should Indiana be now publicly urging its boys to remain in the country and shun the city? Why should men be sending off to mid-Africa for plants and shrubs to decorate their homes, wasting their time and money in try-

ing to keep them up in their unnatural surroundings, when nearly every road-side and woodland contains many of our own plants that are fully equal in beauty and vastly better fitted for life here, but are passed by under the name of weeds? Why should many of our invaluable bits of natural scenery be continually torn up and "improved" for financial purposes? Why should it practically require an armed guard to prevent one of our stateliest and most venerable objects of national pride, the giant sequoias in California, from being splintered into pickets for grape arbors? In most cases it is because the actual value of the country and of its common familiar objects is not known. Our education leads away from the woods and fields and waters, the atmosphere of our main occupation, instead of toward them. In Forbes's words again, "One's resources of enjoyment become so narrowed that he is often an object of pity when seen away from the city street. The ordinary tourist in our national park—one of the loveliest spots on earth—rushes from hot springs to geyser and from geyser to cañon and away again behind six-horse teams, often grumbling then that there is not a locomotive to whisk him about; and if he lingers at all by that lovely wayside, it is only to fish." To how many of us will these words apply? How many of us have uncles or cousins or at least neighbors who go touring in just this way, who went thru the Chicago exposition thus, and repeated the performance at St. Louis, all because they have lost the power of intelligent enjoyment of things beyond their own little spheres?

With these industrial and esthetic conditions of our daily life before us, the question narrows down to how they may best be met. Very evidently this must be thru the rising generation. The first course in our chimney must be laid at the bottom. We need a quickening towards nature in the country and among the children, not simply in a few colleges and universities, and among a few nature lovers of the city. We need something that will keep us open-minded and whole-souled; something that will enable us to become more

effective citizens because more intelligent in our command of those forces relating to the common things of life. These functions and more, we claim for nature study. It gives the child the means of health; it emancipates him from fear and superstition; it keeps his mind pure by giving it a healthy and natural content; and, as Professor Jackman puts it, "It should lead him to look things squarely in the face, to get at genuine values—neither over nor under—and to be moral from principle."

To accomplish these results we must keep our work balanced. It is very true that there has been too much fad and unattached emotion in what has been called nature study. But where the subject has been entered into at all and has become anything more than another cram and book study with little or no observation of any sort, it has been beset with a new danger, that of undue emphasis on a single phase, to the detriment of many other equally valuable things. The aim of nature study is simple enough. Mrs. Comstock puts it, "as primarily to cultivate the child's power of observation and to put him in sympathy with outdoor life." Bailey's chapter in *The Nature Study Idea* reduced to its lowest terms, defines it as an attempt to relate education directly to the life that the pupil is to live. It is to give him an intelligent sympathy with nature and his environment, to the end that his life may be stronger and more resourceful. Hodge in *Nature Study and Life* defines it as "learning those things in nature that are best worth knowing to the end of doing those things that make life most worth living .....What things are best worth knowing is [shown] by the relations toward nature that the human race has found necessary and valuable to develop." These relations at first are mainly biological, including the mastery of animals and plants.

The keynotes to the first two views are power to see, and sympathy; to the third, the keynote is industrial improvement; and at Columbia University it is apparently the educational value that

is uppermost. Each one no doubt recognizes the validity of the claims of the others, and emphasizes the most important phase from his point of view. But from our point of view, it seems that we should be after all these values. They are mutually beneficial—symbiotic, in technical terms—and there is danger of losing the whole coalition if we emphasize one of the symbionts to the exclusion of the others. The man who pins his faith to any single phase will fail to get permanent results. Bringing this to earth, it follows that a boy is not likely even to begin raising chickens, much less to become proficient in it, unless he becomes interested in the life of the chicken, knows something of its relations to comfort and disease, and sees the advantage of putting his ideas into practice.

As to what we should study in nature work, we say the *whole natural* environment within the reach of the child. Everything the Creator has made is worthy of our serious and continued study. That was the idea that controlled Agassiz and that has controlled all his famous pupils to this day. And we have done a great thing if we can impress the child with this fact. He will never be out of something to do. Of course, in the limited time of the classroom, selections must be made bringing out the best that is in the environment; but they should be clearly seen as only selections, and by no means the only objects worthy of our attention. The work should fit the season and locality, have definite trend, and run at least thru one year, or thru all the grades. We would make the emphasis largely biological in the fall, meteorological and physical in the winter, and geological and agricultural in the spring; the bearing upon the needs of actual life always being considered. The character of the agricultural work has been well presented by President Felmley in the *Normal School Quarterly* for January, 1903. This work should give scientific insight into the fundamental farm processes. We believe with Bailey that it is the fundamentals and

principles of farming instead of the incidentals that should get first attention. We do not care to sew on the buttons before cutting out the garment. We should show the why's and how's of soil tillage, of plant propagation and growth, and of animal husbandry. The school garden makes the proper laboratory for the first two phases, and will be abundantly serviceable if properly used. But without a little of the theory and of the understanding mind back of the raking and planting there is a question as to whether work in the garden should not fall in the athletic department, instead of in the academic.

In biological nature work, the fundamental principle is the study of the whole life of the organism. Processes, activities, relations to environment and to man, ready recognition of friends and foes with proper remedial measures, constitute some of the minor objective points. But following out the main principle, we find rich fields that are being neglected in the less complete plans of work.

The whole life of plants means from seed to seed, their winter aspects as well as their summer, and includes the wild as well as the domesticated forms. We don't wish to study plants merely when they are at their best, in the height of summer and of flower. We can't sympathize with things until we know something of their vicissitudes, something of the struggle by which they meet this or that assailant. As Mrs. Comstock says, "To study plants only when in blossom is like speaking to your friends only when they are dressed up." We are likely to miss the most interesting phases anyhow, unless we see the plant thru at least one year. The individuality maintained in meeting the various conditions of the year is remarkable. Take the one phase, the winter condition of our woody plants. To many people, buds exist only in the spring, and trees stand thru the winter all alike, merely leafless specters. But a closer view shows such difference of buds and twigs, in color, shape,

covering and arrangement, as to enable them easily to be separated into genera and in nearly all cases into species. In my own work on willows—one of the bugbears of botany—I was able to make out clearer and surer distinctions to the twenty-three species growing around Ithaca, N. Y., than I have yet found in their summer aspects. The same success is being achieved by Dr. Foxworthy and Dr. Wiegand of Cornell, who are using winter characters in the production of a complete key to our woody plants.

But our work on plants must not end with simple observation. Observation is only the first step in knowing, and it demands supplement by experiment, comparison, generalization and deductive verification. Experiment should be used freely. The pupil must be stimulated to develop skill and ability in growing and propagating plants and in the art of making them comfortable. That is what it all should lead to anyhow. We need more public benefactors in the Horace Greeley sense,—those who can make two blades of grass grow where only one grew before.

The same principle holds in the study of animals. To study an animal in a single stage for a small part of a single day, is nearly the limit of inadequacy. We know far too little of the wild life around us. We hardly know what animals should, and what should not be exterminated, much less how. We ought to know the whole life stories of our animal contemporaries, wild and domestic, their origin upon the earth when possible, the outlines of their history in it, and especially what they are doing around us now both in winter and summer. It is only the complete picture that will satisfy or that will enable us to cope intelligently with our enemies and we should rest with nothing short of it.

This plan makes us investigators. It organizes our work. It puts the textbook where it belongs—a thing to be used whenever it will further our inquiries, and emphasizes the necessity of getting the living animals where they can be kept under observation. We

must form collections. We must make aquaria and terraria, and stock them with living forms, making the occupants as comfortable and putting them as nearly into natural conditions as possible. We should form permanent collections to show the life histories, samples of work, and the relations to environment of our native forms. It is no easy task to do this. Eternal vigilance is the price of a good collection, as well as of other things. But if properly used its value cannot be over-estimated. A child will read about the transformations of insects and even look at their pictures until he can recite them backwards and forwards, all as a matter of course. But just place a set of forms, from egg to adult, before him and tell him that these things are all the same insect, and note the wonder that spreads over his face, and the animated questions that spring up in the presence of the actual things. Our samples of work, in these collections, should make clear our friends and foes. We can show insects and their destroyed vegetation, injured wood, grain, fruit, meat, fur and cloth; and on the other hand we can show them as friends, scavengers, "cannibals," and slayers of injurious forms. This work need not stop with insects. The earthworm with it cocoon and effect on soil; reptiles and their eggs; birds with nests and eggs, to a limited extent; and toads, frogs, and other Amphibia are full of interest and their doings should be known.

The imitation of the natural conditions of animals is important in several ways. One never knows what he is going to discover when he starts out to imitate an animal's surroundings. I suppose I had always known, *e. g.,* that a toad had a warty, granular, and dirty looking back. But of what use such a back could be to him was never clear, until our specimen began to hibernate and to gradually sink away into the sand of a terrarium. When he got down on a level with the surface he stopped, and there was never a better imitation of a sandy surface than that back presented. Our toad could sit there and blink away, seeing without being

seen, occasionally pouncing out to catch a last straying insect before taking his winter nap, and altogether presenting about as comfortable and as unexpected an example of protective resemblance as I have ever seen. Many caterpillars, katydids and grasshoppers can also be made much more valuable for study if mounted to show their protective colorations.

Much effective experimental work can be brought to the aid of the observation here, as well as in plants. We can test the strength and athletic powers of insects; the action of kerosene upon young mosquitoes, the effect of poison in checking insect ravages; or we may try to settle the question as to why the earthworms are so plentiful after a rain, by testing their reactions to light, temperature, and moisture; or the question whether the fish swims with fins or tail, by the use of rubber bands.

Excellent individual investigations may be carried on and reported in short essays on local topics, along the lines suggested in Needham's *Outdoor Studies.* Also bulletins showing the investigations of others may be reviewed and reported on from time to time, including such topics as "The relation of mosquitoes to health," "Relation of birds to agriculture," "Structure of the corn kernels," "Corn breeding," and "Maintenance of fertility in Illinois soils."

These investigations and reviews are generally eye-openers. It is remarkable what can be learned at our very doorsteps. When a bit of feverfew will reveal ants and aphids and ladybugs and aphis-lions robbing, killing, fleeing, hiding, protecting, defending, and rewarding each other with all the earnestness of a life and death struggle, it is not necessary to go to the wilds of Africa, or even to the World's Fair, to get something to see and wonder at. Yet just these things and much more are what did take place summer before last at our doorstep, and probably at thousands of others thruout the country.

Meager as our knowledge of the common wild animals is, the situation is not much improved when we turn to the domestic side. In spite of the intimate daily contact with many of our domesticated animals, how much do we really know about them? How many of us have even a fairly complete and accurate picture of them as they originated and lived in the past? as they live now upon the earth? What native traits and capacities enabled them to succeed in the wild where so many others failed? What attracted man to their aid and use? What objectionable traits have been eliminated? What are their present uses and breeds, over the earth; and how have they been produced? How should they be fed and cared for? How many of us know the majority of these things concerning even one domestic animal? Yet this is only a part of what Professor Forbes believes the study of our domestic animals should bring out. If this plan is applied to the horse, ox, sheep, cat, dog, pig, chicken, and turkey, it is evident that abundant work of a kind very near home, will be provided. To illustrate its workings we present a brief outlined study of our most important domestic animal, the ox. This study is a modification of some work done under Forbes and Davenport at the University of Illlinois, and the sources used were the works of Schmeil, Darwin, Geikie, and Lydeker, together with stock records. This is an excellent, practical field for investigation and essay work by some of the older pupils for report to the class.

THE STORY OF THE OX.

Far back in the past before there were any people; before the ice-sheets had swept down from the North; while mastodons, colossal ruminants, fierce carnivora, and troops of rhinoceroses and elephants held sway; when it would have been really dangerous to try to live; in those times which geologists call the Pliocene period, there appeared in Europe a huge, massive, light-colored wild ox. It

appears to have sprung from a race of large antelopes, and it was apparent from the first that it was going to make no mean race in the struggle for life. With its keen sense of sight, smell and hearing, the dimmed traces of which remain today in the elongated, horizontal pupils of eyes once bright and beady, in the large, moist nostrils, and in the trumpet-shaped movable ears, it was not easily surprised. When once at bay it plied its sharp horns often fifty inches in span, with a powerful neck and massive strength not soon to be forgotten. Its divided stomach and rough, muscular tongue unimpeded by upper teeth in front, enabled it to sweep in its food with great rapidity and then rush back from the open places to chew it in hiding and at rest, thus saving exposure, energy, and amount of food required to live.

But this met only its animal assailants. Those more insistent dangers of the cold, the storm, the treacherous swamp and miry salt lick and stream were upon it. It met the cold with a heavy coat of hair, the storm with a leathery skin, and the mire with a cloven hoof—a most ingenious device—the two toes spreading apart when entering the mud and closing again when lifted, avoided the suction so dangerous to the piston-like hoof of the horse.

By the time man appeared upon the earth, our ox had grown great in numbers as well as in individuals. Man found him roaming the forests and plains from Britain to Greece in great wild droves, and immediately gave chase. The flint hatchets and pierced skulls of the peat bogs tell the story. These prehistoric hunters were after meat. To them this Aurochs or Urus, as it was called, was a manufacturer, a transformer of materials intrinsically worthless—grass, weeds, twigs, and leaves—into most excellent food and clothing for man. And this has been our attitude ever since. This brought man to the ox, first as an enemy, then, to prevent extermination, as a friend. This it is that makes the ox

our most important domestic animal, and the one probably last to be given up, as the competition for the world's supply of plant food increases.

How the ox has changed under man's hand, how it has broken up into breeds so distinct as to appear of different origins, how its uses have been increased and differentiated in the various parts of the world, are matters of record. In answer to the first we will note only the securing of quicker development, the reduction and even removal of horns, as in the Polled Durhams and others, and the extension and increase of the milk flow—110 pounds per day being the record.

Its present uses upon the earth vary from the utter indifference of the Chinese to the almost complete bondage of the many Swiss and Dutch families who depend on their cow for nearly everything. Between these extremes there are all intermediate grades. It is still a game animal in parts of Asia and Africa; a pack animal among the Filipinos; a traction animal with the Hungarians; a milk producer on a small scale among the Italians, where a single cow and calf constitute a street dairy; an object of worship among the people of India; a milk and cheese producer among the Dutch and Swiss, giving us our breeds of Holstein-Friesian and Brown Swiss cattle; and finally a beef-animal to the Anglo-Saxon (who also cares somewhat for milk), giving us our Shorthorns, Herefords, Anguses, Galloways and others. But our packing houses do not stop here. Even the hair, horns, bones, and hoofs are put to service. The hair is made into felt boots and mattresses, the horns into combs, buttons, knife handles and ornaments; and the bones into knife handles and fertilizers.

The method of properly caring for cattle, the uses and mixing of balanced rations, the bases for judging dairy and beef cattle, and the status of "residual milking" carry us beyond the limits of this paper, and can be better obtained from agricultural bulletins. But

if enough has been given to show the availability of our domestic animals merely as an animal study, and especially if this indicates a way to get the country boy to take more pride in his work, to get a better understanding of it and consequently to become a more effective worker in the world, our efforts will have been abundantly repaid.

We have now discussed why nature should be studied; we have shown its relation to agricultural teaching, something of what it should include, something of the principles that should guide us in its organization and presentation; and it remains for us to consider *where* it should be taught. Industrially speaking this last question is self-answering. The all-important place for nature study is in the country school; and the farmers are beginning to find it out. But why those schools are not yet doing their full duty is due to two facts. The teachers are not yet awake to the importance of the movement; and when they do awake they are already so crowded with recitations that they can't determine either what to do or how to do it. The first part of our problem then is to reach the teacher, and since he is so often the product of his own school this is not easy to do. We have to reach the rising generation thru one that is nearly always an immediate offshoot of that generation. The opening of the country schools to the elements of natural science has been a problem in our state ever since the founding of this Normal School. It was because of it that the science requirement was added to teachers' certificates in 1872, but a year later was repealed from the second grade, thus defeating its purpose. Its solution demands continual pegging away at the doors of our country schools; and the vast increase in nature literature, papers like *Country Life,* paid lecturers on agricultural education, and the national movement nature-ward, all point to the speedy opening of those doors.

The second part of the problem—what to do in these schools, and how, is dependent upon knowledge. The teachers hesitate to take up a new study, and we are ready to admit that to bring out the real possibilities of the subject is no holiday task. Like other things of value it is not going to come without some work. But if the facts were really known, of how much can be done with jars and aquaria, simple insect cages, tin cans, window boxes and a garden strip; with the aid of a few good books like those of Comstock, Hodge, Bailey, King, Hemenway, Keeler and Chapman; and without a single set lesson in school hours, by merely turning loose the instinctive love of collecting and of doing, on the part of the pupils; if the teachers could see how the nature study spirit is able to change the whole attitude of the school and teacher from that of "impossible cram and mental pretense" to relations of mutual helpfulness, where all are learners together, and it is no disgrace to say, "I don't know," where questions continually arise that "all the wise men cannot answer;" if these things, I say, were widely known, the hesitation would vanish. There is no need of adding a new recitation to the school. In my opinion nothing will kill the movement so quickly as the cut and dried lesson; and it's a sin to try to crowd any more recitations into the country school program. But if the work is taken up in this informal way, at any rate in the beginning, and the beneficent influences of nature and quickened observation are permitted to spread out over the proverbial three R's, over the geography, and composition and literature, we believe that there will never be a return to the old conditions.

The Illinois State Normal University

Offers to prospective teachers excellent facilities for professional study.

Its four chief programs of study are adapted to students entering with various degrees of preparation.

Its courses include all the branches taught in elementary and high schools, including vocal music, drawing, manual training, and nature study as related to agriculture.

Its library of 15,000 volumes is fully indexed for use in reference.

Its museum, four laboratories, and work shop are well equipped with new apparatus.

Its training department includes 400 pupils under eight critic teachers, and a kindergarten of forty children.

Numerous elective higher courses are offered.

Experienced teachers not wishing to complete the entire course may take special courses.

Tuition is free to all expecting to teach in the schools of Illinois.

Write for catalog.

DAVID FELMLEY, *President.*

3 0112 105727454

PANTAGRAPH
PRINTING AND
STATIONERY Co
Bloomington, Ill.